X. "The Reserve Proteid of the Asparagus Root." By S. H. Vines, F.R.S., and J. R. Green, M.A., F.L.S. Received June 10, 1892.

The object of research was the determination of the nature of the substance, presumably a proteid, from which is formed the asparagin which is so abundantly present in the young shoots of the plant in the spring. The researches were carried on during the springs of 1891 and 1892, and results have been obtained which are sufficiently definite for publication.

Microscopical Observations.—When a transverse section of a fresh root, taken from the plant while in a state of winter-rest, is mounted in alcohol on a slide, and is at once examined with the microscope, some of the parenchymatous cortical cells are seen to contain relatively large masses of irregular shape. When water is run under the cover-slip these masses at once dissolve. From their general appearance and their reaction with iodine these masses probably consist of some form of proteid.

Chemical Observations.

a. Watery Extract.—The watery extract was made by pounding the fresh root in a mortar with distilled water (generally 100 c.c. water to 100 grams root), and straining off and filtering the liquid. The resulting extract was faintly yellow, slightly opalescent, and feebly acid. On boiling it gave a dense precipitate, which gave a good xanthoproteic reaction, thus indicating its proteid nature. The liquid filtered off from the precipitate gave a faint xanthoproteic reaction. In some experiments the extract was carefully neutralised with ammonia to precipitate the phosphates, and then some common salt (NaCl) was added to throw down a substance of unknown nature but not a proteid, the presence of which was detected at an early stage in the investigation; the neutral liquid then filtered off gave only a turbidity on boiling; when the liquid was made slightly alkaline the same result was given; but in both cases when the extract was made faintly acid a good precipitate was obtained on boiling. The coagulation point was determined to be 71—73° C.

The watery extract gave a good xanthoproteic reaction; a fairly good reaction with Millon's reagent; no satisfactory reaction with acetic acid and potassic ferrocyanide or with potassic hydrate and copper sulphate.

When alcohol in excess was added there was a dense precipitate which at first was soluble again in water, but which became for the most part insoluble if allowed to remain for some time in contact

with the alcohol. This precipitate when suspended in water, after prolonged contact with alcohol, gave a good xanthoproteic reaction.

When the watery extract was allowed to drop into a tall jar containing distilled water, there was no precipitation or turbidity. Similarly, when some of the extract was diluted with fifteen times its volume of distilled water, and a stream of CO_2 was passed through the liquid for 1—6 hours, no turbidity was apparent.

When some of the extract was subjected to dialysis in a stream of running water for four days, and the dialysis afterwards continued for two days in large excess of distilled water, a finely granular precipitate was formed in the dialyser, which when filtered off gave no xanthoproteic reaction, whilst the filtrate still coagulated at 71° C.

The proteid was therefore soluble in distilled water, being thrown down neither by dilution nor dialysis.

Portions of the extract were shaken up to saturation for some days with crystals of the following neutral salts: NaCl, $MgSO_4$, $MgSO_4$ and Na_2SO_4, $(NH_4)_2SO_4$.

With NaCl there was a slight precipitation of the proteid, but the greater part of it remained in solution.

With $MgSO_4$ there was a more copious, but still incomplete, precipitation of the proteid: on saturating the filtrate with Na_2SO_4 no further precipitate fell.

With $(NH_4)_2SO_4$, when the saturation was continued for a month, the whole of the proteid was precipitated.

b. Salt Solution Extract.—This extract was prepared by using 10 per cent. solution of NaCl instead of distilled water, as in the former experiments. The reactions were generally the same as those given by the watery extract; but the undetermined substance, which is precipitable by salt, was present in much smaller quantities, and the precipitates of proteid were less bulky than those given by the watery extract.

Conclusions as to the Proteid.—It appears from the foregoing experiments that the root of the asparagus contains a single reserve proteid. Inasmuch as it is readily soluble in distilled water, it is essentially an albumin; at the same time, its reactions with neutral salts indicate a relationship to the globulins which is not manifested by the animal albumins. However, proteids other than globulins are precipitated on saturation of their solutions with neutral salts; thus Schäfer* and Halliburton† have both shown that serum-albumin is completely thrown down on double saturation with magnesium and sodium sulphates, and Kühne and Chittenden‡ have found that the

* 'Journal of Physiology,' vol. 3, 1882, p. 184.

† *Ibid.*, vol. 5, 1884, p 178.

‡ "Ueber Albumosen," 'Zeitschrift für Biologie,' xxii.

albumoses are precipitated by NaCl from their, in some cases neutral, in others faintly acid, solutions.

Besides the proteid we have found three undetermined substances in the extracts, neither of which is proteid. The first of these (1) is the substance which is present in considerable quantity in the watery extract, and which is precipitated on adding a small amount of salt.

(2.) When a portion of the first extract is freed from proteid by boiling, and then the filtrate poured into alcohol, a precipitate is formed, fairly copious but much less than that formed when the unboiled extract is similarly neutral, as described above. This remains soluble in water after prolonged action of the alcohol, but the solution gives no xanthoproteic reaction.

(3.) When the alcohol is evaporated to dryness a sticky residue is left, which also is soluble in water, and its solution gives a fair xanthoproteic reaction. This is not proteid, however, as it is soluble in alcohol. This substance can be extracted from the fresh extract by dialysing it in distilled water. On concentrating this dialysate a similar sticky residue is obtained. In several cases this brown, sticky mass deposited crystals of rounded form, much resembling in appearance the well-known aggregations of leucin. They were not leucin, however, as besides being soluble in cold alcohol they did not give the characteristic Scherer's reaction, nor did they form a compound with the acetates of lead or zinc. It is not improbable that this third undetermined substance may be allied to leucin, asparagin, &c., but our observations on it are as yet incomplete.

XI. "Note on the Structure of *Rhabdopleura*." By G. Herbert Fowler, B.A., Ph.D., Assistant in the Zoological Laboratory of University College, London. Communicated by Prof. W. F. R. Weldon, F.R.S. Received June 13, 1892.

The specimens investigated were attached to a colony of *Lophohelia*, obtained by the "Challenger" Expedition at Nightingale Island, from a depth of 100—150 fathoms. I owe to Mr. John Murray my thanks for his courtesy in allowing me to publish my notes on the structure of this interesting form, in which I hoped that the improved methods of microscopical research introduced in recent years might reveal points which had, perhaps, escaped the two observers to whose study of the living animal we owe our present knowledge of *Rhabdopleura*.

All the new anatomical features which I have been able to detect are in entire agreement with the structure of *Cephalodiscus; Rhabdopleura* may thus be taken to form a third member of Bateson's order, the Hemichordata. They are, briefly, as follows:—